



PATENT
1928-0154P

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: Ben To Fan WONG Conf.:
Appl. No.: 10/721,095 Group:
Filed: November 26, 2003 Examiner: UNASSIGNED
For: END CAP ASSEMBLY

L E T T E R

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

January 22, 2004

Sir:

Under the provisions of 35 U.S.C. § 119 and 37 C.F.R. § 1.55(a), the applicant(s) hereby claim(s) the right of priority based on the following application(s):

<u>Country</u>	<u>Application No.</u>	<u>Filed</u>
GREAT BRITAIN	0228010.5	November 30, 2002

A certified copy of the above-noted application(s) is(are) attached hereto.

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Respectfully submitted,

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Attachment(s)





10/721,095
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END CAP ASSEMBLY
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INVESTOR IN PEOPLE

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1. Your reference

MRH.PO4745GB /P367

2. Patent application number

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30 NOV 2002

0228010.5

3. Full name, address and postcode of the or of each applicant (*underline all surnames*)

Johnson Electric S.A.
Rue Fritz-Courvoisier 40
CH-2300 La Chaux-de-Fonds
Switzerland

Patents ADP number (*if you know it*) 04018313005

If the applicant is a corporate body, give the country/state of its incorporation

Switzerland

4. Title of the invention

End Cap Assembly

5. Name of your agent (*if you have one*)

Marks & Clerk

"Address for service" in the United Kingdom to which all correspondence should be sent (*including the postcode*)

27 Imperial Square
Cheltenham GL50 1RQ
England

Patents ADP number (*if you know it*)

18014 ✓

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (*if you know it*) the or each application number

Country

Priority application number
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Date of filing
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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (*Answer 'Yes' if:*

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- a) any applicant named in part 3 is not an inventor, or
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Patents Form 1/77

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Continuation sheets of this form	0
Description	4
Claim(s)	2
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Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77) 1

Request for substantive examination (Patents Form 10/77)

Any other documents
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11.

I/We request the grant of a patent on the basis of this application.

Signature

M. R. Higgins

Date

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29th November 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

Mr M R Higgins
01242 524520

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End Cap Assembly

This invention relates to electric motors and in particular, to an end cap for a pm_{dc} motor.

5

Two speed pm_{dc} motors are known where the speed change is obtained by using a three brush construction where one brush is common and the other two brushes are selectively used for low speed or high speed operation.

- 10 The low speed brush is generally located 180° opposite the common brush and the high speed brush is located between the other two brushes, generally about 90° from the common brush. Such an arrangement works well for a single direction motor but for a two speed bi-directional motor, there is a big difference in the no load speed between clockwise and counterclockwise high speed operation. This has been
15 generally tolerated as a failing of a two speed pm_{dc} bi-directional motor.

Attempts to correct this undesirable characteristic include the use of two high speed brushes, one for each direction, resulting in a four brush system. This provides a satisfactory solution but the four brushes are fixed to the end cap assembly in
20 predetermined spatial locations. The speed of the motor in high speed mode can be adjusted slightly by changing the angular displacement or location of the high speed brushes with respect to the common brush. As end caps are molded parts with the brush cages being an integral part of the end cap, to change the speed of the high speed mode required a new end cap to be formed requiring a new end cap die, etc.

25

Thus, it is desirable for an end cap which can be assembled with two brush cages at fixed locations and having the option to add one or two additional brush cages which can be located within a predetermined angular displacement from the fixed location brush cages.

30

Accordingly, the present invention provides an end cap assembly for an electric motor comprising: an outer part supporting a bearing and motor terminals; and an inner part having a first brush cage, a second brush cage spaced from the first brush cage by 180°, and provision for locating a third and a fourth brush cage at a desired location
35 circumferentially between the first and second brush cages.

Preferred and/or optional features are set forth in the dependent claims.



By using an end cap assembly of this type, the same end cap assembly can be used with all 4 brush configurations, as well as 2 brush and 3 brush configurations which leads to a substantial reduction in inventory, better utilization of parts and standardization of assembly procedures.

5

One preferred example of the invention will now be described by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a partial sectional view of a miniature electric PMDC motor incorporating an end cap assembly according to the present invention;

10

Figure 2 illustrates an inside view of an inner part of the end cap assembly; and

Figure 3 is a section view through a part of the inner part of Figure 2.

15

Figure 1 is a partial sectional view of a miniature PMDC motor 10. The motor has a tubular steel housing 12 with two open ends. One end is closed by a single piece moulded plastic or resin end cap 14 supporting a first bearing 19. The other end of the housing is closed by a two part moulded resin end cap 16. End cap 16 also supports a bearing 20. Located within the housing is a rotor 22 comprising a motor shaft 24 journaled in the bearings 19, 20, a rotor core 26 wound with rotor windings (omitted for clarity) and a commutator 27 to which the rotor windings are terminated.

20

End cap 16 has an outer part 28 and an inner part 30. The outer part 28 supports the bearing 20, motor terminals and noise suppression components. The inner part 30 supports further noise suppression components and the brush gear. The outer and inner parts are held together mechanically by posts on the outer part which are glued or welded (e.g. by ultrasonic welding) onto holes in the inner part. The two parts are electrically connected together by mechanical type connections which grip corresponding connections when the two parts are pressed together.

30

The inner part 30 is shown in plan view in Figure 2 where four chokes 32 and capacitors 34 of the noise suppression components can be seen. Four brushes 35, 37, 39, 41 and brush cages 36, 38, 40, 42 are also visible. Each brush has a shunt 44 which is welded to a connector plate 46 which has a slot which straddles and grips an end of a choke wire to make electrical connection therewith. The connector plate is located in a recess 48 next to the choke and connection with the choke wire is made as the connector plate 46 is pressed into the recess 48.

35



Brush 35 and its brush cage 36 is designated as the common brush as it is always connected to the power supply when the motor is operating. Brush 37 is designated the low speed brush as it is connected to the power supply when the motor is operating in the low speed mode, either direction. Brush 39 is designated the high speed clockwise brush as it is connected to the power supply only during high speed clockwise operation and brush 41 is the high speed counterclockwise brush as it is connected to the power supply only during counterclockwise high speed operation.

Brush cages 36 and 38, the common cage and low speed cage, respectively, are integrally moulded into the inner part. The basic inner part 30 is an annular brush card with the two integrally moulded brush cages. Connection buses 49, 50, 51, 52 may be moulded into the brush card with connection terminals extending axially outwardly for connection to the outer part 28 as required. Choke holders 54 are also integrally moulded to the brush card. There are two planar areas 56, symmetrically located adjacent the common brush cage 36. Each area 56 has an arcuate groove 58. These areas 56 are where the high speed cages 40, 42 are to be located and fixed to the brush card. The high speed brush cages are separate moulded cages which, during assembly, if needed, are fixed to the brush card by known means such as epoxy resin adhesion or ultrasonic welding.

As shown in Fig. 2 and in Fig. 3, where the high speed CW brush assembly is shown in cross-section, the high speed brush cages 40, 42 have a generally tubular shape with a square cross-section. The axially inner wall of the cage has a slot 60 for the shunt 44 of the brush which is slidably received within the cage and extends radially inwardly under the urging of a spring 62 bearing against a brass clip 64 closing the radially outer end of the cage. The axially outer surface 66, the lower surface as shown in Figure 3, of the cage has a circumferentially extending transverse projection 68 which engages the arcuate groove 58 in the brush card. This sets the precise radial distance of the cage from the motor axis. A further projection 70 at the rear of the cage for attaching the brush clip 64 also assists in locating the cage radially.

The precise circumferential location of the high speed cage 40, 42 with respect to the common brush cage 36 can be set during assembly within the planar area 56. In the embodiment shown, the high speed brush cages 40, 42 can be located within the spatial angles of 75° to 90° . This means that the angle between the radial center line of the common brush and the radial center line of the high speed brush is between 75° and 90° . The radial center line passes through the center of the end cap which

corresponds to the rotor axis in use and through the center of the brush/brush cages. The precise angular positioning can be easily set using an appropriate assembly jig.

- 5 Thus, two, three and four brush end cap assemblies can be produced using a single set of end cap dies and for three and four brush systems, the precise angular displacement of the third and fourth brushes can be varied according to application needs without requiring new dies or parts or other changes to the end cap except as can be arranged during the assembly process.
- 10 The embodiment described above is given by way of example only and various modifications will be apparent to persons skilled in the art without departing from the scope of the invention as defined in the appended claims.



Claims

1. An end cap assembly for an electric motor comprising:
an outer part supporting a bearing and motor terminals; and
5 an inner part having
a first brush cage, a second brush cage spaced from the first brush cage by
180°, and provision for locating a third and a fourth brush cage at a desired location
circumferentially between the first and second brush cages.
- 10 2. An assembly according to claim 1, wherein the first and second brush cages
are integrally molded with the inner part.
3. An end cap assembly according to claim 1 or 2, wherein the third and fourth
brush cages are locatable angularly spaced between 75° and 90° from the first brush
15 cage.
4. An end cap assembly according to claim 1, wherein the third and fourth brush
cages are fixed to the inner part by an epoxy resin.
- 20 5. An end cap assembly according to claim 1, 2 or 3, wherein the third and fourth
brush cages are molded resin parts and are joined to the inner part by ultrasonic
welding.
6. An end cap assembly according to claim 1, wherein a detent is formed between
25 the third and fourth brush cages and the inner part which detent radially locates the
third and fourth brush cages so that each of the brush cages has a corresponding part
located at an equal radial distance from a central axis of the end cap.
7. An end cap assembly according to claim 6, wherein the detent means
30 comprises projections on an axially outer mating surface of each of the third and
fourth brush cages which engage arcuate grooves in an axially inner locating surface
of the inner part and the locating surface is juxtaposed the mounting surface of each
of the third and fourth brush cages to set the radial distance while allowing the
circumferential spacing to be determined during fixing of the third and fourth brush
35 cages to the inner part during assembly.
8. An end cap assembly according to any one of the preceding claims, wherein
the inner and outer parts have noise suppression components.



9. An end cap assembly according to claim 8, wherein the noise suppression components of the inner part includes chokes connected to shunts of brushes slidably mounted in the brush cages by way of a link connector which makes a mechanical type connection with the choke.
- 5
10. An end cap assembly for an electric motor substantially as hereinbefore described with reference to the accompanying drawings.



Abstract

5 An end cap 16 for a miniature electric pm dc motor has two fixed brush cages 36, 38 moulded integrally with the end cap and two separate brush cages 40, 42 which are attached to the end cap 16 during the assembly process. The angular separation of the fixed brush cages 36, 38 and the separate brush cages 40, 42 is determined during assembly so that the angle can be adjusted to suit the application of the motor.

10 Figure 2



1/2

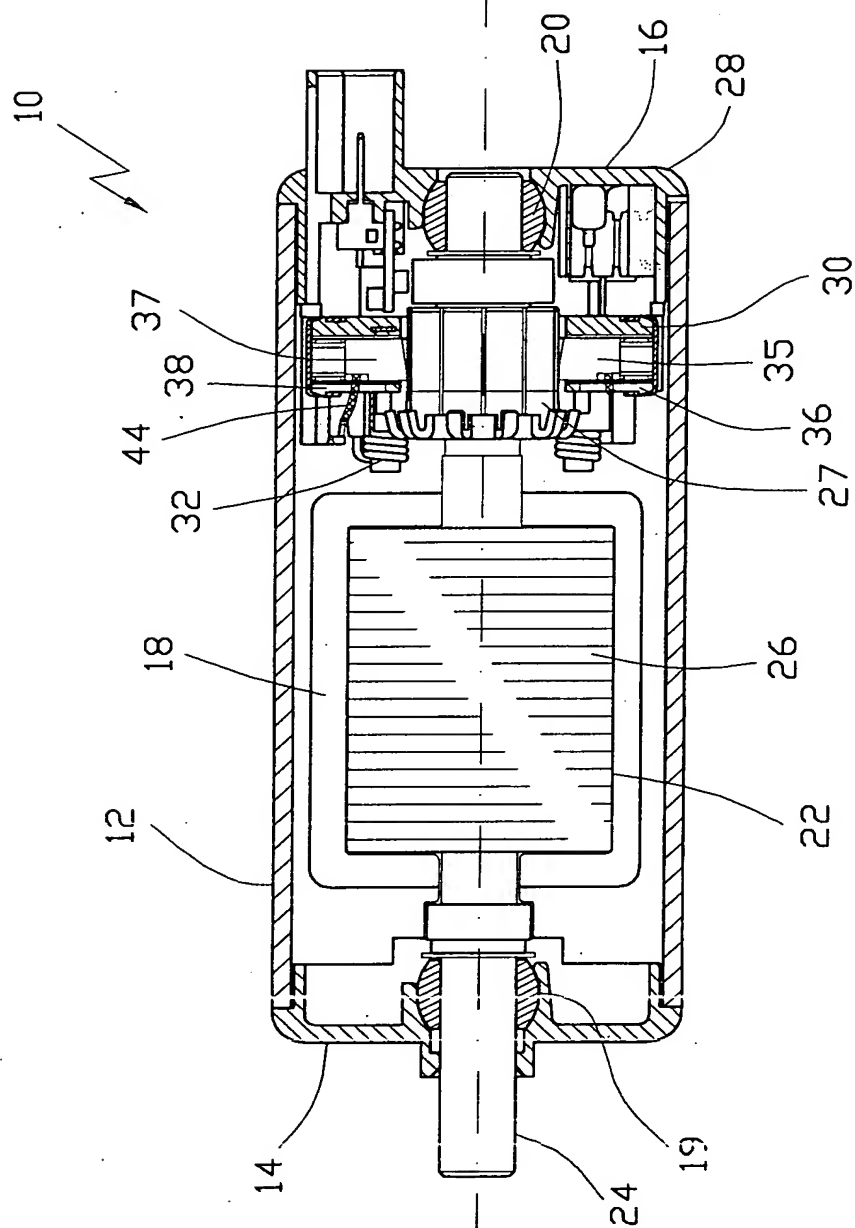


FIG. 1





